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EXAMINER	
WALTER, CRAIG E	
ART UNIT	PAPER NUMBER
2188	

DATE MAILED: 02/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/600,417	BURTON ET AL.	
	Examiner	Art Unit	
	Craig E. Walter	2188	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *15 November 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *14,22 and 26-32* is/are allowed.

6)☒ Claim(s) *1,2,4,6,7,12,17,19 and 25* is/are rejected.

7)☒ Claim(s) *3,5,8-11,13,15-16,18, 20-21, and 23-24* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 June 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Status of Claims

1. Claims 1-6, 9-11, 13-14, 16-17, 22 and 25 have been amended.

Claims 26-32 are new.

Claims 1-32 are pending in the application.

Claims 1, 2, 4, 6, 7, 12, 17, 19 and 25 are rejected.

Claims 3, 5, 8-11, 13, 15-16, 18, 20-21, and 23-24 are objected to.

Claims 14, 22 and 26-32 are allowed.

Response to Amendment

2. Applicant's amendments filed on 15 November 2005 in response to the action mailed on 12 July 2005 have been fully considered, and have necessitated new grounds of rejections. Justification for providing Applicant with the new grounds of rejection is specifically addressed in the section titled "Response to Arguments" in this correspondence.

Claim Objections

3. Claims 16 and 25 objected to because of the following informalities:

As for claim 16, the phrase "sending destage operation complete status" in line 4 should be changed to "sending a destage operation complete status".

As for claim 25, the phrase "the target VLUN" in line three of this claim should be changed to "a target VLUN". In addition, the phrase "the original dirty data" referenced in line five should be changed to "original dirty data".

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claim 25 is rejected under 35 U.S.C. 102(e) as being anticipated by Armangau (US Patent 6,434,681 B1).

As for claim 25, Armangau teaches a method of an error recovery process in a data storage system wherein a first host verifies that original dirty data has or has not been destaged to a target VLUN, comprising:

(a) reading a bitmap wherein if the bitmap contains a value in a bit position representing the original dirty data in cache memory (note col. 8, lines 52-57 the primary storage within the production volume can contain SRAM which is serving as a cache memory), destaging the data to the target VLUN, and wherein if the bitmap contains an inverse value in a bit position representing the presence of the original

data in the target VLUN, not destaging the data (col. 4, lines 24-40, determining whether or not the data has been modified is performed by reading the status of the bit. Further, storage space is allocated for the data to be copied to the snapshot location);

(b) removing the dirty data designation for the destaged data (col. 4, lines 41-43; changing the bit in the bit map); and

(c) repeating the steps (a) and (b) until all of the original dirty data is destaged (col. 16, lines 30-34; a track copy pointer is used as a place holder which steps through all of the tracks of the production volume until the entire volume has been searched for modified data).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1, 2, 4, 6, 7, 12, 17 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Armangau in further view of Cochran et al., hereinafter Cochran (US PG Publication 2004/0024961 A1).

As for claim 1, Armangau discloses a method of snapshot operation for a data storage system with a first host (Fig. 2, element 31) that communicates with a cache memory (Fig. 2, element 47 the cache memory is contained within the storage

subsystem—see col. 8, lines 53-57), a source VLUN (Fig. 5, element 101), and a target VLUN (Fig. 5, element 103), comprising:

generating first metadata to locate first snapshot data and to indicate when the first snapshot data is in the target VLUN (pointers (Fig. 5, element 106) are used to reference tracks in the snapshot volumes that contain the original data of the snapshot, col. 13, line 66 through col. 14 line 3); and

generating second metadata to locate second snapshot data and to indicate when the second snapshot data is in the target VLUN (the index (Fig. 5, element 111) acts as a translation table to indicate which track number of the production volume R corresponds the track number of the snapshot volume x-- col. 14, lines 43-45), wherein the first and second metadata locate the same data in the target VLUN (the index and pointers refer to the same data in snapshot volume x—col. 14, lines 35-45; the index can also refer to the pointers themselves which are pointing to data located in snapshot volume x). Alternatively, since each of the pointers contained in the list (Fig. 5, element 106) refer to a unique snapshotted production volume extent (track), each pointer within the list is a unique metadata referring to each snapshot (col. 13, line 67 through col. 14 line 7).

Despite these teachings, Armangau fails to disclose the first and second metadata as locating *an original data element of the first snapshot data and of the second snapshot data at the same address* in the target VLUN as recited by Applicant in amended claim 1.

Cochran however teaches a full logical-unit copy with a transient snapshot copy like intermediate stage, in which elements within a Primary LUN are maintained and updated in a Copy LUN as modifications (i.e. write operations) are performed on the Primary LUN. Referring to Figs. 10A-G of his disclosure, Cochran discusses creating a copy (i.e. snapshot copy) of several (three in this example) of the data elements in the Primary LUN (Fig. 10B, element 1002), and storing the copied data into a Copy LUN (Fig. 10B, element 1004) – Paragraph 0042, lines 1-18. Modifications are made (i.e. by a write operation) to one of those three elements in the Primary LUN (referring to Fig. 10C, data element "Z" is being written to the second location of the Primary LUN), at which at a later time the data element "Z" is written to the Copy LUN to maintain consistency with the Primary LUN (Fig. 10D, element "Z" is written to the second location of the Copy LUN). After the second copy operation has been performed, an original data element (i.e. element "X" in the first location of the Primary LUN) is still located in the first location of the Copy LUN. In other words, the original data element is at the same address at the time of both the first and second copy operations as recited by Applicant in claim 1. Note Cochran specifically uses the letter "X" to denote data *originally* presented in the Primary LUN (paragraph 0038, lines 15-18).

It would have been obvious to one of ordinary skill in the art at the time of the invention for Armangau to include Cochran's system of LUN snapshot copy operation into his own snapshot copy facility storage system. Armangau system would benefit from the use Cochran's Primary LUN and Copy LUN for snapshot operation, as it would allow him to maintain snapshots of only data that has been modified from the

original data set, rather than simply appending each snapshot to the snapshot volume as presently taught by Armangau. By doing so, Armangau would not only be making more efficient use of memory (by storing only changes rather than the entire data set), he would also have a more efficient LUN copy operation which is extremely important to mass-storage systems as taught by Cochran in paragraph 0015, lines 1-19.

As for claim 2, Armangau in further view of Cochran discloses the method of claim 1, wherein generating the first metadata includes generating a first log file pointer to locate *the original data element* in the target VLUN (pointers (Fig. 5, element 106) are used to reference tracks in the snapshot volumes that contain the original data of the snapshot, col. 13, lines 66 through col. 14 lines 3). The combination of Armangau and Cochran would allow for Armangau's pointers to point to the original data stored in the Cochran's Copy LUN.

As for claim 4, Armangau in further view of Cochran discloses the method of claim 1, wherein generating the second metadata includes generating a second log file pointer to locate *the original data element* in the target VLUN. Referring to Fig. 5, the pointers referencing the data stored in snapshot volume x are contained in a list (element 106). The combination of Armangau and Cochran would allow for Armangau's pointers to point to the original data stored in the Cochran's Copy LUN.

Again, it would have been obvious to one of ordinary skill in the art at the time of the invention for Armangau to include Cochran's system of system of LUN snapshot copy operation into his own snapshot copy facility storage system. Armangau system would benefit from the use Cochran's Primary LUN and Copy LUN

for snapshot operation, as it would allow him to maintain snapshots of only data that has been modified from the original data set, rather than simply appending each snapshot to the snapshot volume as presently taught by Armangau. By doing so, Armangau would not only be making more efficient use of memory (by storing only changes rather than the entire data set), he would also have a more efficient LUN copy operation which is extremely important to mass-storage systems as taught by Cochran in paragraph 0015, lines 1-19.

As for claim 6, Armangau teaches a snapshot system for a data storage system including a first host that communicates with a cache memory, a source VLUN, a target VLUN, and metadata, comprising:

a source VLUN for active data (production volume R);

a target VLUN to store migrated snapshot data (snapshot volume x);

first metadata to indicate when and to locate where the first snapshot data is in the target VLUN (pointers are used to point to the tracks in the snapshot volume that contain the original data of the snapshot (col.13, line 67 through col. 14 line 3). It is worthy to note that Armangau's system further includes a list of free track pointers (Fig. 5, element 109), which can be used to determine when data has been stored in the snapshot volume by removing the pointer from the list of pointers pointing to free tracks (col. 14, lines 3-7);

and second metadata to indicate when and to locate where second snapshot data is in the target VLUN wherein the first metadata and the second metadata to indicate and locate the same snapshot data in the target VLUN (again,

the index (Fig. 5, element 111)) is used translate the production volume track number to the corresponding snapshot volume number. Armangau's index can therefore be further used to determine when snapshot data is in the snapshot volume by checking the table to see if one or many of the production tracks correspond to the snapshot tracks.

Despite these teachings, Armangau fails to disclose the first and second metadata as indicating and locating *a data element common to the first and second* snapshot data in the target VLUN.

Cochran however teaches a full logical-unit copy with a transient snapshot copy like intermediate stage, in which elements within a Primary LUN are maintained and updated in a Copy LUN as modifications (i.e. write operations) are performed on the Primary LUN. Referring to Figs. 10A-G of his disclosure, Cochran discusses creating a copy (i.e. snapshot copy) of several (three in this example) of the data elements in the Primary LUN (Fig. 10B, element 1002), and storing the copied data into a Copy LUN (Fig. 10B, element 1004) – Paragraph 0042, lines 1-18. Modifications are made (i.e. by a write operation) to one of those three elements in the Primary LUN (referring to Fig. 10C, data element "Z" is being written to the second location of the Primary LUN), at which at a later time the data element "Z" is written to the Copy LUN to maintain consistency with the Primary LUN (Fig. 10D, element "Z" is written to the second location of the Copy LUN). After the second copy operation has been performed, an original data element (i.e. element "X" in the first location of the Primary LUN) is still located in the first location of the Copy LUN. In other words, the original data element

is at the same address at the time of both the first and second copy operations as recited by Applicant in claim 1. Note Cochran specifically uses the letter "X" to denote data originally presented in the Primary LUN (paragraph 0038, lines 15-18).

It would have been obvious to one of ordinary skill in the art at the time of the invention for Armangau to include Cochran's system of system of LUN snapshot copy operation into his own snapshot copy facility storage system. Armangau system would benefit from the use Cochran's Primary LUN and Copy LUN for snapshot operation, as it would allow him to maintain snapshots of only data that has been modified from the original data set, rather than simply appending each snapshot to the snapshot volume as presently taught by Armangau. By doing so, Armangau would not only be making more efficient use of memory (by storing only changes rather than the entire data set), he would also have a more efficient LUN copy operation which is extremely important to mass-storage systems as taught by Cochran in paragraph 0015, lines 1-19.

As for claim 7, Armangau teaches the snapshot system of claim 6, wherein the first metadata includes a first log file pointer to locate the first snapshot data in the target VLUN and the second metadata includes a second log file pointer to locate the second snapshot data in the target VLUN. Just as with claim 4, each pointer in the list points to a different track in snapshot volume x, therefore each pointer itself is a unique metadata.

As for claim 12, Armangau teaches the snapshot system of claim 6, wherein the first metadata indicates that the original data of the first snapshot is in the target VLUN and the second metadata indicates that the original data of the second

snapshot is in the source VLUN (each pointer points to the track location on the snapshot volume indicating where the original data is located (col.13, line 67 through col. 14 line 3)).

As for claim 17, Armangau teaches a method of snapshot operation in a data storage system in a first host that communicates with a cache memory, a source VLUN, a target VLUN, first metadata, and second metadata, comprising:

receiving requests from an application to modify data in the cache memory (col. 7, lines 1-6 the host requests modification of data in the primary storage area (cache) within the primary storage subsystem);

writing the modified data to the cache memory (modified data can be written once the remote copy flag is inspected by the primary storage subsystem – col. 7, lines 5-11);

destaging the original data to the target VLUN to preserve the original data of a first snapshot and a second snapshot (col. 7, lines 18-25 the data is copied from the primary storage area to a different set of primary storage locations (target VLUN));

and updating the first and second metadata to locate the original data in the target VLUN (the list of pointers as referenced in col. 7 lines 18-20 are used to locate data of both old and new versions of the storage units).

Despite these teachings, Armangau fails to disclose the first and second metadata locating the original data element *common to the first and second snapshot* data in the target VLUN.

Cochran however teaches a full logical-unit copy with a transient snapshot copy like intermediate stage, in which elements within a Primary LUN are maintained and updated in a Copy LUN as modifications (i.e. write operations) are performed on the Primary LUN. Referring to Figs. 10A-G of his disclosure, Cochran discusses creating a copy (i.e. snapshot copy) of several (three in this example) of the data elements in the Primary LUN (Fig. 10B, element 1002), and storing the copied data into a Copy LUN (Fig. 10B, element 1004) – Paragraph 0042, lines 1-18. Modifications are made (i.e. by a write operation) to one of those three elements in the Primary LUN (referring to Fig. 10C, data element "Z" is being written to the second location of the Primary LUN), at which at a later time the data element "Z" is written to the Copy LUN to maintain consistency with the Primary LUN (Fig. 10D, element "Z" is written to the second location of the Copy LUN). After the second copy operation has been performed, an original data element (i.e. element "X" in the first location of the Primary LUN) is still located in the first location of the Copy LUN. In other words, the original data element is at the same address at the time of both the first and second copy operations as recited by Applicant in claim 1. Note Cochran specifically uses the letter "X" to denote data *originally* presented in the Primary LUN (paragraph 0038, lines 15-18).

It would have been obvious to one of ordinary skill in the art at the time of the invention for Armangau to include Cochran's system of system of LUN snapshot copy operation into his own snapshot copy facility storage system. Armangau system would benefit from the use Cochran's Primary LUN and Copy LUN for snapshot operation, as it would allow him to maintain snapshots of only data that has been modified from the

original data set, rather than simply appending each snapshot to the snapshot volume as presently taught by Armangau. By doing so, Armangau would not only be making more efficient use of memory (by storing only changes rather than the entire data set), he would also have a more efficient LUN copy operation which is extremely important to mass-storage systems as taught by Cochran in paragraph 0015, lines 1-19.

As for claim 19, Armangau teaches the method of claim 17, further comprising updating the first and second metadata to indicate the presence of the destaged original data in the target VLUN (again a pointer for each snapshotted track is used to locate the original data of the snapshot (col. 13 line 67 through col. 14 line 3)).

Allowable Subject Matter

6. Claims 14, 22, and 26-32 are allowed.

7. Claims 3, 5, 8-11, 13, 15-16, 18, 20-21, and 23-24 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Further, claims 16 and 25 would need to be rewritten to overcome the objections set forth under section 3 of this correspondence.

Response to Arguments

8. With respect to Applicant's discussion on page 12, lines 20-22 of the "Remarks" document, Examiner maintains the objection to claim 25. Applicant has acknowledged

a correction is required (by indicating the intention to amend), but failed to amend the claim as per Examiner's suggestion.

9. Examiner further contents that despite Applicant's arguments with respect to amended claim 25, Armangau does in fact anticipate the limitations recited in the claim. More specifically, Applicant asserts that the bitmaps do not represent original dirty data in the cache. Referring again to the previously cited lines (col. 4, lines 24-43), the bit within the bit map is checked to see if the production data set has been modified (emphasis added). In other words, the bitmap will not indicate that the data is dirty, until the data originally stored in the memory has been modified. Applicant further asserts that Armangau's bitmaps do not represent when data is destaged to the target LUN. Again referring to the previously cited lines in col. 4, Armangau specifically teaches changing the bit once the data is copied (once the copy operation completes, data at the location can be modified since the previous data has been copied). Lastly Applicant asserts Armangau fails to teach removing the dirty data designation for the destaged data. Again referring to col. 4, the data is no longer dirty once it has been copied, at which point the bit map is changed to indicate that it has been copied, hence the dirty data designation has been removed.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Ohran (US PG Publication 2003/0101321 A1) teaches a system and method for preserving a snapshot of selected data of a mass storage system.

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

12. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Craig E. Walter whose telephone number is (571) 272-8154. The examiner can normally be reached on 8:30a - 5:00p M-F.

14. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mano Padmanabhan can be reached on (571) 272-4210. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

15. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Craig E Walter
Examiner
Art Unit 2188

CEW

Reginald G. Bragdon